STACK GAS EMISSION TEST PROGRAM INTERMOUNTAIN POWER PROJECT

UNIT 1

VOLUME 1 STACK GAS EMISSION MONITOR CERTIFICATION TEST PROGRAM

PREPARED FOR:
INTERMOUNTAIN POWER PROJECT
DELTA, UTAH

PREPARED BY:
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KVB, INC.
ENGINEERING AND RESEARCH DIVISION
AUGUST 1987

KVB62 503320-1895



SUMMARY

Unit #1 is a new steam generator located at the Intermountain Power Project Steam Generating Station in Delta, Utah. This plant is owned and operated by Intermountain Power Project, Delta, Utah (IPP). The stack gas emissions from Unit 1 are regulated by the United States Environmental Agency (EPA) New Source Performance Standards as set forth in the Code of Federal Regulations (CFR), Title 40, Part 60, Subpart Da and the State of Utah modified approval order dated December 19, 1985. As a requirement of the subpart Da and the regulations of the State of Utah, IPP is required to continuously monitor the stack gas emissions from Unit 1.

To comply with the emission regulations, IPP purchased a continuous emission monitor from KVB, Inc.; Equipment Systems Division, to monitor the stack gas emissions from Unit #1 at the Intermountain Power Project Steam Generating Station. The monitor is composed of a Western Research Model 721A 5O₂ Analyzer, a TECO Model 10AR NOx Analyzer, a Thermox Model WDG III Oxygen Analyzer, and a Lear Siegler Model RM-41 Opacity Monitor.

A test program was conducted by KVB, Inc. to demonstrate the ability of the emission monitor to comply with the performance specifications as required by the EPA and the State of Utah. The relative accuracy portion of the test program was subcontracted to Clean Air Engineering, Inc. The test program was conducted in accordance with the procedures outlined in CFR Title 40, Part 60, Appendix B, Performance Specifications 1, 2, and 3 as revised in the Federal Register on March 30, and May 25, 1983.

The monitor, Serial No. 503320, was found to meet all of the performance specifications as required by the EPA and the State of Utah. The requirements for each test and the results are presented in Tables 1 and 2. During the monitor certification test program, the boiler was operated in excess of 50% of normal load except where noted in this document. During the relative accuracy tests the boiler was operated at full load. The certification test program was successfully completed on June 28, 1986.

TABLE 1. SUMMARY OF MONITOR PERFORMANCE TEST DATA

		Capitlantian	
		Specification Requirement	Monitor
		(40 CFR 60.	Serial
Parameter		Appendix B)	No. 503320
PERF	ORMANC	E SPECIFICATION 1 - OP	ACITY
Lear Siegler Model RM-41	Opacity N	Monitor, Serial No. 136164	<u>35</u>
Design Specifications			
Peak Spectral Respon	se	500-600 NM	560 NM
Mean Spectral Respon		500-600 NM	567.4 NM
Angle of View		<u>4</u> 50	40
Angle of Projection		<u>=</u> 50	3 ⁰
Performance Data			
Calibration Error-	Low	≟ 3%	 5%
	Mid	≥ 3%	4%
	High	<u>∠</u> 3%	1.4%
Zero Drift (24-hour)		<u>4.2%</u>	.39%
Span Drift (24-hour)		<u>~</u> 2%	.91%
Response Time		10 sec max	5.6 SEC
Operational Test Peri	od	168 Hr. min	168 Hr.
	**	****	
PER	RFORMAN	NCE SPECIFICATION 2 -	NOx
TECO Model 10AR NOx A	nalyzer,	Serial No. 10AR-19309-18	3 - INLET
Accuracy			
Volumetric (ppm)		∠ 20%	2.98%
Mass (Ib/MBTU)		20%	2.26%
Zero Drift (24-Hour)		<u></u> ∠ 2%	. D5%
Span Drift (24-Hour)		2.2%	.57%
Operational Test Period		168 Hrs. min.	168 Hrs.

TABLE 1. SUMMARY OF MONITOR PERFORMANCE TEST DATA cont.

Requirement (40 CFR 60, Appendix B)			
Parameter Appendix B No. 503320		Specification	* * * * * * * * * * * * * * * * * * * *
Parameter Appendix B No. 503320			
TECO Model 10AR NOx Analyzer, Serial No. 10AR-16553-162 - STACK	Dana sakar		
Accuracy Volumetric (ppm) Mass (lb/MBTU) Zero Drift (24-Hour) Span Drift (24-Hour) Derational Test Period Mestern Research Model 721A, Serial No. 86-721A-6245-3 Low (0-500 ppm range) Mestern Research Model 721A, Serial No. 86-721A-6245-5 STACK Accuracy Volumetric (ppm) Mass (lb/MBTU) Zero Drift (24-Hour) High (0-1000 ppm range) Low (0-100 ppm range)	Parameter	Appendix B)	No. 503320
Volumetric (ppm) 4 20% 10.04% Mass (lb/MBTU) 4 20% 11.95% Zero Drift (24-Hour) 2 2% .08% Span Drift (24-Hour) 2 2% .99% Operational Test Period 168 Hrs. min. 168 Hrs. PERFORMANCE SPECIFICATION 2 - 502 Western Research Model 721A, Serial No. 86-721A-6245-3 - INLET Accuracy Volumetric (ppm) 4 20% 6.80% Mass (lb/MBTU) 4 20% 8.83% Zero Drift (24-Hour) High (0-1000 ppm range) 4 2% .39% Low (0-500 ppm range) 4 2.5% .27% Low (0-500 ppm range) 4 2.5% .27% Low (0-500 ppm range) 4 2.5% .173% Operational Test Period 168 Hours Min. 168 Hrs. low range Western Research Model 721A, Serial No. 86-721A-6245-5 - STACK Accuracy Volumetric (ppm) 4 20% 15.28% Mass (lb/MBTU) 4 20% 15.28% Accuracy 1.57% 2.5% Volumetric (ppm) 4 20% 1.57%	TECO Model 10AR NOx Analyzer	, Serial No. 10AR-16553-16	52 - STACK
Volumetric (ppm)	Accuracy		
Mass (Ib/MBTU) ₹ 20% 11,95% Zero Drift (24-Hour) ₹ 2% .08% Span Drift (24-Hour) ₹ 2% .99% Operational Test Period 168 Hrs. min. 168 Hrs. PERFORMANCE SPECIFICATION 2 - SO2 Western Research Model 721A, Serial No. 86-721A-6245-3 - INLET Accuracy Volumetric (ppm) ₹ 20% 6.80% Mass (Ib/MBTU) ₹ 20% 8.83% Zero Drift (24-Hour) ₹ 2% .39% High (0-1000 ppm range) ₹ 2% .39% Low (0-500 ppm range) ₹ 2.5% .27% Low (0-500 ppm range) ₹ 2.5% 1.73% Operational Test Period 168 Hours Min. 168 Hrs. low range Western Research Model 721A, Serial No. 86-721A-6245-5 - STACK Accuracy Volumetric (ppm) ₹ 20% 15.28% Mass (Ib/MBTU) ₹ 20% 1.57% Low (0-100 ppm range) ₹ 2% 1.57% Low (0-100 ppm range) ₹ 2% 1.51% Span Drift (24-Hour) ₹ 20% 1.51% High (0-1000 ppm range) <td></td> <td>∡ 20%</td> <td>ነስ በለዓሩ</td>		∡ 20%	ነስ በለዓሩ
Zero Drift (24-Hour)			–
Span Drift (24-Hour) 22% .99%		2070	11./3/0
Span Drift (24-Hour) 22% .99%	Zero Drift (24-Hour)	∡. 2%	.08%
Departional Test Period 168 Hrs. min. 168 Hrs.			
PERFORMANCE SPECIFICATION 2 - 5O ₂ Western Research Model 721A, Serial No. 86-721A-6245-3 - INLET Accuracy Volumetric (ppm)		-	
Western Research Model 721A, Serial No. 86-721A-6245-3 INLET		200 1 199, 1111112	100 198
Western Research Model 721A, Serial No. 86-721A-6245-3 INLET	PERFORM	IANCE SPECIFICATION 2 -	SO ₂
Accuracy Volumetric (ppm) ∠ 20% 6.80% Mass (lb/MBTU) ∠ 20% 8.83% Zero Drift (24-Hour) High (0-1000 ppm range) ∠ 2% .39% Low (0-500 ppm range) ∠ 2% 1.91% Span Drift (24-Hour) High (0-1000 ppm range) ∠ 2.5% .27% Low (0-500 ppm range) ∠ 2.5% 1.73% Operational Test Period 168 Hours Min. 168 Hrs. low range Western Research Model 721A, Serial No. 86-721A-6245-5 - STACK Accuracy Volumetric (ppm) ∠ 20% 15.28% Mass (lb/MBTU) ∠ 20% 16.30% Zero Drift (24-Hour) ∠ 20% 1.57% Low (0-100 ppm range) ∠ 2% 1.51% Span Drift (24-Hour) ∠ 2% 1.51% High (0-1000 ppm range) ∠ 2.5% .80% Low (0-100 ppm range) ∠ 2.5% .80% Low (0-100 ppm range) ∠ 2.5% .80%			4.
Volumetric (ppm) ∠ 20% 6.80% Mass (lb/MBTU) ∠ 20% 6.80% Zero Drift (24-Hour) .39% .39% High (0-1000 ppm range) ∠ 2% 1.91% Span Drift (24-Hour) .25% .27% High (0-1000 ppm range) ∠ 2.5% .27% Low (0-500 ppm range) ∠ 2.5% 1.73% Operational Test Period 168 Hours Min. 168 Hrs. low range Western Research Model 721A, Serial No. 86-721A-6245-5 - STACK Accuracy Volumetric (ppm) ∠ 20% 15.28% Mass (lb/MBTU) ∠ 20% 16.30% Zero Drift (24-Hour) ⊢ 1.57% Low (0-100 ppm range) ∠ 2% 1.51% Span Drift (24-Hour) ⊢ 1.51% 5.28% 1.51% High (0-1000 ppm range) ∠ 2.5% .80% Low (0-100 ppm range) ∠ 2.5% .80% Low (0-100 ppm range) ∠ 2.5% .80%	Western Research Model /21A, S	erial No. 86-721A-6245-3 -	INLET
Mass (lb/MBTU)			
Zero Drift (24-Hour) High (0-1000 ppm range)			
High (0-1000 ppm range) Low (0-500 ppm range) Low (0-500 ppm range) Span Drift (24-Hour) High (0-1000 ppm range) Low (0-500 ppm range) Low (0-500 ppm range) Low (0-500 ppm range) Department Test Period Mestern Research Model 721A, Serial No. 86-721A-6245-5 Accuracy Volumetric (ppm) Mass (lb/MBTU) Zero Drift (24-Hour) High (0-1000 ppm range) Low (0-100 ppm range) Low (0-1000 ppm range) Low (0-1000 ppm range) Low (0-1000 ppm range) Low (0-1000 ppm range)	Mass (lb/MBTU)	₹20%	8.83%
Low (0-500 ppm range)	Zero Drift (24-Hour)		
Low (0-500 ppm range)	High (0-1000 ppm range)	∡ 2%	.39%
Span Drift (24-Hour) 2.5% .27% Low (0-500 ppm range) ≥2.5% 1.73% Operational Test Period 168 Hours Min. 168 Hrs. low range Western Research Model 721A, Serial No. 86-721A-6245-5 - STACK Accuracy Volumetric (ppm) ≥20% 15.28% Mass (lb/MBTU) ≥20% 16.30% Zero Drift (24-Hour) +320% 1.57% Low (0-100 ppm range) ≥2% 1.51% Span Drift (24-Hour) +32% 1.51% High (0-1000 ppm range) ≥2.5% .80% Low (0-100 ppm range) ≥2.5% .80% Low (0-100 ppm range) ≥2.5% 1.86%			
High (0-1000 ppm range)		adha.	4.2 4.10
Low (0-500 ppm range) ∠2.5% 1.73% Operational Test Period 168 Hours Min. 168 Hrs. low range Western Research Model 721A, Serial No. 86-721A-6245-5 - STACK Accuracy Volumetric (ppm) ∠20% 15.28% Mass (lb/MBTU) ∠20% 16.30% Zero Drift (24-Hour) ∠2% 1.57% Low (0-100 ppm range) ∠2% 1.51% Span Drift (24-Hour) ∠2.5% .80% High (0-1000 ppm range) ∠2.5% .80% Low (0-100 ppm range) ∠2.5% 1.86%		4 2.5%	27%
Operational Test Period 168 Hours Min. 168 Hrs. low range Western Research Model 721A, Serial No. 86-721A-6245-5 - STACK Accuracy Volumetric (ppm) ∠ 20% 15.28% Mass (lb/MBTU) ∠ 20% 16.30% Zero Drift (24-Hour) ∠ 2% 1.57% Low (0-100 ppm range) ∠ 2% 1.51% Span Drift (24-Hour) ∠ 2.5% .80% Low (0-100 ppm range) ∠ 2.5% .80% Low (0-100 ppm range) ∠ 2.5% 1.86%			
Western Research Model 721A, Serial No. 86-721A-6245-5 - STACK Accuracy Volumetric (ppm) ∠ 20% 15.28% Mass (lb/MBTU) ∠ 20% 16.30% Zero Drift (24-Hour) ∠ 2% 1.57% Low (0-100 ppm range) ∠ 2% 1.51% Span Drift (24-Hour) ∠ 2.5% .80% Low (0-100 ppm range) ∠ 2.5% .80% Low (0-100 ppm range) ∠ 2.5% 1.86%			
Accuracy Volumetric (ppm)	operational rest remod	TOO LIOUIS MILL!	Too Lits' fom Laude
Volumetric (ppm) ∠ 20% 15.28% Mass (lb/MBTU) ∠ 20% 16.30% Zero Drift (24-Hour) ∠ 2% 1.57% High (0-1000 ppm range) ∠ 2% 1.51% Span Drift (24-Hour) ∠ 2.5% .80% High (0-1000 ppm range) ∠ 2.5% 1.86%	Western Research Model 721A, S	erial No. 86-721A-6245-5 -	STACK
Volumetric (ppm) ∠ 20% 15.28% Mass (lb/MBTU) ∠ 20% 16.30% Zero Drift (24-Hour) ∠ 2% 1.57% High (0-1000 ppm range) ∠ 2% 1.51% Span Drift (24-Hour) ∠ 2.5% .80% High (0-1000 ppm range) ∠ 2.5% 1.86%	Accuracy		
Mass (lb/MBTU) ≤28% 16.30% Zero Drift (24-Hour) + 1.57% 1.57% High (0-1000 ppm range) ≤2% 1.51% Span Drift (24-Hour) + 2.5% .80% High (0-1000 ppm range) ≤2.5% 1.86%		∠ 20%	15.28%
Zero Drift (24-Hour) High (0-1000 ppm range) Low (0-100 ppm range) Span Drift (24-Hour) High (0-1000 ppm range) Low (0-100 ppm range) Low (0-100 ppm range) 2.5% .80%	Mass (lb/MBTU)		-
High (0-1000 ppm range) ≥2% 1.57% Low (0-100 ppm range) ≥2% 1.51% Span Drift (24-Hour) 22.5% .80% High (0-1000 ppm range) ≥2.5% 1.86%	- the state of the form of the form	- 	Appendix of the
Low (0-100 ppm range) ∠2% 1.51% Span Drift (24-Hour) 2.5% .80% High (0-1000 ppm range) ∠2.5% 1.86% Low (0-100 ppm range) ∠2.5% 1.86%			
Low (0-100 ppm range) ∠2% 1.51% Span Drift (24-Hour) 2.5% .80% High (0-1000 ppm range) ∠2.5% 1.86% Low (0-100 ppm range) ∠2.5% 1.86%		<u>~</u> 2%	1.57%
Span Drift (24-Hour)			
High (0-1000 ppm range)			
Low (0-100 ppm range) <u>∠</u> 2,5% 1.86%		∠ 2.5%	.80%
	Operational Test Period	168 Hours Min.	168 Hrs, low range

PERFORMANCE SPECIFICATION 3 - 02

Thermox WDG-III Oxygen Analyzer, Serial No. C026344-1 - INLET

Zero Drift (24-Hour)	∠0.4% O ₂	0.00%
Span Drift (24 Hour)	∠0.5% O ₂	0.08%
Accuracy	∠20%	3.14%
Operational Period	168 Hrs. Min.	168 Hrs.
Thermox WDG-III Oxygen Analyzer,	Serial No. C026776-1 - STACK	

Zero Drift (24-Hour)	∠0.4% O ₂	0.00%
Span Drift (24 Hour)	Z0.5% O2	0.00%
Accuracy	_20%	3.68%
Operational Period	168 Hrs. Min.	168 Hrs.

TABLE 2. 24-HOUR DRIFT TABULATIONS AS PERCENT OF SPAN VALUE (ABSOLUTE VALUES)

INLET

TEST NO.			ZERO SPAN ZERO SPAN ZERO SPAN				ZERO SPAN (0-25%)	
1.	0_	2.5	.7	.6	.1	.6	0	2
2.	.1	.8	O _.	3.3	1.3	1.8	0	O
3.	.1	.4	1.2	.2	.3	.4	0	.1
4.	0	.1	.4	.8	G	.5	0	מ
5.	.1	.4	.4	.8	.2	.9	Õ	Õ
6.	.1	.2	0	0	.2	.1	Ō	Ď
7.	0	0	.2	.6	.2	.3	Õ	.1
8.	0	.7	0	.6	.4	.1	Ď	.1
9.	.1	0	.4	.8	.1	.4	ō	ä
10.	.1	.7	.B	.8	0	.3	Ō	Õ

LIMITS: NOx & SO2 42.5%, O2 40.5%

NOTE: THE BOILER WAS ON LINE AND OPERATING ABOVE 50% OF NORMAL LOAD FOR THIS SERIES OF DRIFT TESTS EXCEPT WHERE NOTED BELOW.

- 1. The test period for this drift test series is May 26 through June 5, 1986.
- 2. Boiler was off line on the following days May 29 & 30, June 1 & 2, 1986.

TABLE 2. 24-HOUR DRIFT TABULATIONS AS PERCENT OF SPAN VALUE (ABSOLUTE VALUES)

STACK

NOx			502					
TEST NO.		ZERO SPAN (0-1000 ppm)		ZERO SPAN ZERO SPAN ZERO SPAN (0-1000 ppm) (0-1000 ppm) (0-1000 ppm)			ZERO ² SPAN (0-25%)	
1.	,1	2.5	0	1	1.2	2.2	0	0
2.	0	1.2	1	3	.3	.5	0	.2
3.	.1	2.0	6	2	3.1	.9	0	.2
4.	0	•6	2	1	1.0	.3	0	0
5.	0	-4	1	0	1.9	.2	Ď	0
6.	Ð	. 4	1	0	.2	.2	0	0
7.	0	0.0	2	1	1.7	.9	0	0
8.	Đ	•5	4	0	1.5	.2	Ō	0
9.	0	.1	4	2	3.1	.1	0	Ö
10.	Ũ	.4	3	0	.8	.5	ō	Ö

LIMITS: NOx & SO2 \$2.5%, O2 \$0.5%

NOTE: THE BOILER WAS ON LINE AND OPERATING ABOVE 50% OF NORMAL LOAD FOR THIS SERIES OF DRIFT TESTS EXCEPT WHERE NOTED BELOW.

- 1. The test period for this drift test series is May 26 through June 5, 1986.
- 2. Boiler was off line on the following days May 29 & 30, June 1 & 2, 1986.

TABLE 2. 24-HOUR DRIFT TABULATIONS AS PERCENT OF SPAN VALUE (ABSOLUTE VALUES)

INLET

TEST NO.	ZERO (0-1000	VOx SPAN I ppm)	ZERO (0-500	SO ₂ SPAN ppm)	ZERO (0-100)	SPAN) ppm)	O ₂ ZERO SPA (0-25%)	
1.	.1	.7	1.4	.6	.3	.2	n	n
2.	0	.1	1.0	1.0	.2	.3	ñ	n
3.	0	.1	2.0	2.0	0.0	.3	õ	.1
4.	0	.2	.8	1.8	0.0	.3	Õ	.ī
5.	0	.8	.2	1.2	•6	.2	Ö	o -
6.	0	.1	1,8	.6	0.0	.1	Ō	.1
7.	0	.5	1.4	1.4	.2	.1	Ö	o o

LIMITS: NOx & SO₂ $\angle 2.5\%$, O₂ $\angle 0.5\%$

NOTE: THE BOILER WAS ON LINE AND OPERATING ABOVE 50% OF NORMAL LOAD FOR THIS SERIES OF DRIFT TESTS EXCEPT WHERE NOTED BELOW.

- 1. The test period for this drift test series is June 21 through June 28, 1986.
- 2. Boiler was off line on the evening of June 25, 1986 for about 3 hrs.

TABLE 2. 24-HOUR DRIFT TABULATIONS AS PERCENT OF SPAN VALUE (ABSOLUTE VALUES)

STACK

TEST NO.	NOx ZERO SPAN (0-1000 ppm)		ZERO SPAN ZERO (0-100 ppm) (0-100			SPAN 0 ppm)	O ₂ ZERO SPAN (0-25%)	
1.	0	.4	а	1	.6	.3	n	n
2.	0	.3 -	Ĩ	Ō	2.1	.1	Ď	ŏ
3.	0	0	0	0	.3	-8	Ď	Ō
4.	.1	.6	1	1	.9	•7	Ō	Ŏ
5.	.1	1.5	3	3	1.0	1.0	0	0
6.	.1	1.5	2	3	2.0	•B	0	а
7.	0	.4	1	1	.1	.4	Ō	0

LIMITS: NOX & SO2 42.5%, O2 40.5%

NOTE: THE BOILER WAS ON LINE AND OPERATING ABOVE 50% OF NORMAL LOAD FOR THIS SERIES OF DRIFT TESTS EXCEPT WHERE NOTED BELOW.

- 1. The test period for this drift test series is June 21 through June 28, 1986.
- 2. Boiler was off line on the evening of June 25, 1986 for about 3 hrs.

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TABLE 2. 24-HOUR DRIFT TABULATIONS AS PERCENT OF SPAN VALUE (CORRECTED COMPUTER VALUES)

STACK

TEST ZERO SPAN NO. (0-1000 ppm)		SPAN	ZERO SPAN ZERO SPAN (0-100 ppm) (0-1000 ppm)				ZERO SPAN (0-25%)		
1.	0	0.1	1.0	1.0	1.2	1.3	D	0	
2.	0	0.2	1.0	1.0	0.5	0.6	0	0	
3.	0	0.6	0	1.0	0,2	0.4	0	0	
4.	0	1.0	1,0	2.0	0.5	1.1	0	0	
5.	0	0.2	1.0	1.0	0.3	0.1	0	0	
6.	0	0.1	0	1.0	1.0	1.5	0	0	
7.	0	0.3	1.0	1.0	1.0	0.3	0	0	

LIMITS: NOx & SO₂ \leq 2.5%, O₂ \leq 0.5%

NOTE: THE BOILER WAS ON LINE AND OPERATING ABOVE 50% OF NORMAL LOAD FOR THIS SERIES OF DRIFT TESTS EXCEPT WHERE NOTED BELOW.

The test period for this drift test series is November 27 through December 3, 1986.